IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Hideo Yamanaka et al.

Confirmation No.: 5089

Application No.: 09/646,680

Art Unit: 1762

Filed: November 4, 2000

Examiner: E. B. Fuller

For: FILM FORMING METHOD AND FILM FORMING APPARATUS

REPLY BRIEF

MS Appeals-Patent
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is a Reply Brief under 37 C.F.R. §41.41 in response to the Examiner's Answer mailed on August 24, 2004.

All arguments presented within the Appeal Brief of July 29, 2003 are incorporated herein by reference. Additional arguments are provided hereinbelow.

Claim 1 is drawn to a film forming method in which a reaction gas is brought into contact with a heated catalyzer and an electric field of not higher than a glow discharge starting voltage is caused to act on the produced reactive species, thereby providing kinetic energy and carrying out vapor growth of a predetermined film on a base. Claims 2-22 are dependent upon claim 1. For purposes of the issues presented by this appeal, claims 1-2, 16-17 and 20 stand or fall together, claims 8-9 stand or fall together, and claims 14 and 21 each stand or fall alone. The Examiner previously withdrew claims 3-7, 10-13, 15, 18-19 and 22 from consideration.

Regarding the rejection of claims 1-2, 16-17 and 20 under 35 U.S.C. §102, the Examiner's Answer contends that U.S. Patent No. 4,961,958 to Desphandey et al. (Desphandey) teaches that a reaction gas is brought into contact with a heated catalyzer and an electric field of not higher than a glow discharge starting voltage is caused to act on the produced reactive species, thereby providing kinetic energy and carrying out vapor growth of a predetermined film on a base.

Within the claims on appeal, a reaction gas is brought into contact with a heated catalyzer. The figures found within the specification for the above-identified application teach the presence of a catalyzer 46.

The Examiner's Answer fails to clearly identify the feature within Desphandey that is intended to be the "heated catalyzer." In this regard, the Examiner's Answer is incomplete. Nevertheless, Desphandey teaches the presence of tungsten filament 46, which will be identified by the Applicant as the heated catalyzer solely for the arguments made in this appeal.

Within the claims on appeal, an electric field of not higher than a glow discharge starting voltage is caused to act on the produced reactive species.

Desphandey arguably teaches that glow discharge optical spectroscopy can be used to study the plasma chemistry and optimize plasma conditions to obtain CBN-diamond films (Desphandey at column 6, lines 21-23). Yet, the term "*a glow discharge starting voltage*" found within the claimed invention is not specifically recited anywhere within Desphandey.

Desphandey arguably teaches that the electrons emitted from the heated filament 46 are accelerated to an anode 49, to which a D.C. potential is applied from a D.C. supply 50, that the usual potential is in the range of about 80 volts, and that higher voltages may be used if desired, by using a R.F. plasma (Desphandey at column 5, lines 47-51).

The Examiner's Answer contends that any voltage that would cause a glow discharge to start would be considered a glow discharge starting voltage (Examiner's Answer at page 8). Yet,

the Examiner's Answer fails to highlight any objective evidence regarding the veracity of this contention. Thus, this contention has been made without any evidentiary support.

As a gap filler, the Examiner's Answer contend that 80 volts *must* also be "a glow discharge starting voltage" (Examiner's Answer at page 8).

In response to this contention, the Examiner's Answer also asserts that 80 volts found within Desphandey *is not of sufficient strength to initiate a glow discharge* in the particular reactants found within Desphandey and that the electric field is used to cause acceleration of electrons and not to create a plasma (Examiner's Answer at page 8). This assertion is contrary to the gap filler noted hereinabove that 80 volts *must also be a glow discharge starting voltage* and lends some confusion regarding the role of the 80 volts found within Desphandey in creating an electric field.

Moreover, Desphandey arguably teaches that a D.C. potential is applied from a D.C. supply 50, and that the usual potential is in the range of about 80 volts (Desphandey at column 5, lines 47-50). Nevertheless, the Examiner's Answer fails to establish the potential found within Desphandey in the range of about 80 volts as a glow discharge starting voltage.

But even if the potential found within Desphandey in the range of about 80 volts is a glow discharge starting voltage, the claimed invention provides that *the electric field of not higher than a glow discharge starting voltage is caused to act on the produced reactive species*, which is not found within Desphandey at least for the following reasons.

Desphandey arguably teaches that a variety of other reactions can take place depending on the energy, concentration and nature of the *reactive species* (excited, *ionized*, etc.) in the plasma volume (Desphandey at column 6, lines 17-20). But the Examiner's Answer fails to identify the feature within Desphandey that is intended to be the "produced reactive species." In this regard, the Examiner's Answer is incomplete.

Nonetheless, Desphandey arguably teaches a support and feed unit 13 for a source carbon rod used for evaporation 14 (Desphandey at column 4, lines 21-22). Furthermore, Desphandey arguably teaches that the filament 46 provides electrons for dissociating and ionizing the gases and the evaporated carbon vapor (Desphandey at column 5, lines 44-45). Solely for the arguments made in this appeal, these gases and the evaporated carbon vapor within Desphandey *after* dissociation and *ionization* will be identified by the Applicant as the *produced reactive species.*

Desphandey arguably teaches that electrons emitted from the heated filament 46 are accelerated to an anode 49, to which a D.C. potential is applied from a D.C. supply 50 (Desphandey at column 5, lines 47-49). While the electrons emitted from the heated filament 46 are to dissociate and ionize the gases and the evaporated carbon vapor (Desphandey at column 5, lines 443-46), there is ***no electric field*** found within Desphandey that will act upon the gases and the evaporated carbon vapor ***after*** their dissociation and ionization.

Thus, Desphandey fails to disclose, teach or suggest an electric field of not higher than a glow discharge starting voltage that is caused to act on the produced reactive species.

Regarding the rejection of claim 14 under 35 U.S.C. §103 as being allegedly obvious over Desphandey in view of U.S. Patent No. 5,900,161 to Doi, within claim 14, after vapor growth of the predetermined film, the base is taken out of a deposition chamber and a voltage is applied between predetermined electrodes to generate plasma discharge, thereby cleaning the inside of the deposition chamber with the plasma discharge.

The above-noted deficiencies found within Desphandey is applicable to the rejection of claims 14 and is incorporated by reference into the following discussion regarding claim 14.

As an initial matter, the Examiner's Answer fails highlight within Desphandey the predetermined electrodes that are used to generate plasma discharge, thereby cleaning the inside of the deposition chamber with the plasma discharge.

However, the Examiner's Answer contends that the skilled artisan would have been motivated in using the cleaning process of Doi.

In response to this contention, there are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. *In re Rouffet*, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998). None of these three possible sources have been shown in the Examiner's Answer.

Regarding the problem to be solved, Doi arguably teaches that in the plasma self-cleaning technique, *silicon-containing compounds* deposited on the electrodes and the inner wall are removed by using reactive chemical species, such as fluorine radicals, produced by an electric discharge plasma (Doi at column 1, lines 45-49). However, the Examiner's Answer fails to show that the silicon-containing compounds found within Doi are also found within Desphandey. While Desphandey arguably teaches the deposition of diamond films, there are no silicon-containing compounds found within Desphandey.

Thus, the problem to be solved by Doi of cleaning *silicon-containing compounds* deposited on the electrodes and the inner wall does not exist within Desphandey.

In addition, Desphandey fails to disclose, teach or suggest the deposition of diamond films on the electrodes and the inner wall of the apparatus of Desphandey, or the need to clean deposited diamond films.

Regarding the teachings of the prior art, and the knowledge of persons of ordinary skill in the art, Examiner's Answer fails to show that the apparatus of Doi would be suitable in producing the diamond films of Desphandey. Instead, the Examiner's Answer admits that Desphandey does not teach the process of cleaning the deposition chamber after the coated substrate has been taken

out (Examiner's Answer at page 4), and further admits that the Examiner does not suggest using the apparatus of Doi in the process taught by Desphandey (Examiner's Answer at page 9). As a result, there is no suggestion within the Examiner's Answer of using the apparatus of Doi in substantially the same manner as the apparatus of Desphandey. See, for example, *In re Dillon,* 13 USPQ2d 1337, 1342 (Fed. Cir. 1989), and M.P.E.P. §2143.01, section "*The Proposed Modification Cannot Change The Principle Of Operation Of A Reference.*"

Furthermore, Desphandey and Doi, either individually or as a whole, fail to disclose, teach or suggest that the fluorine radicals of Doi would be suitable in removing the diamond films of Desphandey, or that the fluorine radicals used the cleaning method of Doi would not damage the apparatus of Desphandey.

Thus, the Examiner's Answer fails to show why the skilled artisan would have applied the cleaning process of Doi to the apparatus of Desphandey.

The Examiner's Answer fails to disclose, teach or suggest Desphandey and Doi, either individually or as a whole, as providing that after vapor growth of the predetermined film, the base is taken out of a deposition chamber and a voltage is applied between predetermined electrodes to generate plasma discharge, thereby cleaning the inside of the deposition chamber with the plasma discharge.

Regarding the rejection of claims 8 and 9 under 35 U.S.C. §103 as being allegedly obvious over Desphandey in further view of Doi and U.S. Patent No. 5,464,499 to Moslehi et al. (Moslehi), within claim 8, the catalyzer is arranged between the base and an electrode for applying the electric field. Claim 9 is dependent upon claim 8.

The above-noted deficiencies found within Desphandey and Doi are applicable to the rejection of claims 8 and 9 and are incorporated by reference into the following discussion regarding claims 8 and 9.

Within claim 8, the catalyzer is arranged between the base and an electrode for applying the electric field.

Desphandey arguably teaches that gas from gas supply 39 is introduced into the apparatus of Desphandey by way of nozzle 41 (Desphandey at figure).

While the Examiner's Answer admits that Desphandey fails to teach the gas distribution means as being an electrode (Examiner's Answer at page 5), the Examiner's Answer fails to rebut the arguments made within the Appeal Brief that Desphandey fails to disclose, teach or suggest the catalyzer 46 arranged between the rod 26 and the metal plate 49.

In addition, Desphandey arguably teaches a base 11 (Desphandey at column 4, line 20). Desphandey teaches the presence of tungsten filament 46, which will be identified by the Applicant as the heated catalyzer solely for the arguments made in this appeal. Yet, Desphandey fails to disclose, teach or suggest the tungsten filament 46 arranged between the base 11 and an electrode for applying the electric field (Desphandey at figure).

Desphandey arguably teaches a frame 25 (Desphandey at column 4, lines 31-32). However, Desphandey fails to disclose, teach or suggest the tungsten filament 46 arranged between the frame 25 and an electrode for applying the electric field (Desphandey at figure).

The Examiner's Answer contends that the arguments set forth within the Appeal Brief only addresses how Desphandey fails to teach that the catalyzer is arranged between the base and an electrode for applying the electric field, as set forth within claim 8, and that the arguments set forth within the Appeal Brief do not refer to how the proposed combination fails to teach the contents of claim 8.

In response to this contention, Doi and Moslehi have been addressed within the Appeal Brief. In particular, arguments made within the Appeal Brief provide that Doi and Moslehi, either individually or as a whole, fail to disclose, teach or suggest the existence of a catalyzer arranged between the base and an electrode for applying the electric field (Appeal Brief at page 12).

But even more specifically, Moslehi arguably teaches a showerhead assembly 52 that includes showerhead injector 54 (Moslehi at figure 1, column 5, lines 21-22).

Claim 8 provides that the catalyzer is arranged between the base and an electrode for applying the electric field.

Desphandey arguably teaches the presence of tungsten filament 46, which has been previously identified by the Applicant as the heated catalyzer solely for the arguments made in this appeal.

Although the record is unclear, perhaps it is the intent of the Examiner's Answer to apply the showerhead assembly 52 of Moslehi as the electrode for applying the electric field within the apparatus of Desphandey.

In this regard, the Examiner's Answer contend that 80 volts must also be "a glow discharge starting voltage" (Examiner's Answer at page 8). In addition, the potential at the anode 49 of Desphandey is about 80 volts (Desphandey at claim 13). Accordingly, the totality of the Examiner's Answer appears to suggest a replacement of the anode 49 of Desphandey with the showerhead assembly 52 of Moslehi, although there is considerable confusion and a lack of clarity within the Examiner's Answer as to the interpretation of the teaching found within Desphandey and Moslehi.

The showerhead assembly 52 of Moslehi includes a channel 60 for providing gas into the processing environment 62. However, nozzle 41 is presently found within the apparatus Desphandey for the introduction of gas from gas supply 39 (Desphandey at figure), and the Examiner's Answer fails to show the need for gas addition to that which is provided from supply 39 of Desphandey.

But even if Examiner's Answer is sufficient in showing the need for a gas in addition to that which is provided from supply 39 of Desphandey, the Examiner's Answer fails to show that the showerhead assembly 52 of Moslehi, if substituted for the anode 49 of Desphandey, would result in

the tungsten filament 46 being arranged between a base (such as the substrate 24) and the showerhead assembly 52 of Moslehi that has replaced the anode 49.

Desphandey arguably teaches a nozzle 41 for introducing gas from a gas supply 39 into the apparatus (Desphandey at figure 1). The Examiner's Answer includes an assertion that Desphandey fails to teach the gas distribution means being an electrode (Examiner's Answer at page 5). Quite possibly, the Examiner's Answer includes an attempt to substitute nozzle 41 of Desphandey with showerhead assembly 52 of Moslehi. However, this attempt lends some considerably confusion at least for the following reasons.

The Examiner's Answer fails to explain the motivation for replacing the nozzle 41 of Desphandey that is not connected to a power source with the showerhead assembly 52 of Moslehi if the showerhead assembly 52 that is connected to electrode line E_2. In this regard, the showerhead assembly 52 of Moslehi would result in an additional electrode within the apparatus of Desphandey that was not previously there. Because the apparatus of Desphandey already includes an anode metal plate 49 and an electron gun 20, and the performance of the apparatus of Desphandey is a function of the anode metal plate 49 and the electron gun 20, there must be an accounting within the Examiner's Answer for the addition of the showerhead assembly 52 and electrode line E_2 of Moslehi into the apparatus of Desphandey, which the Examiner's Answer has failed to provide.

Also note that while a third electrode E_3 of Moslehi is connected to wafer chuck 24 (Moslehi at figure 1, column 5, lines 43-44), no electrode line is connected to frame 25 or rod 26 of Desphandey (Desphandey at figure).

There are other questions that have not been addressed within the Examiner's Answer such as "what is the voltage potential of electrode line E_2 of Moslehi as incorporated into Desphandey", "where is the return for the voltage potential of electrode line E_2 of Moslehi as incorporated into Desphandey", and "where and how would the showerhead assembly 52 of Moslehi as incorporated into Desphandey be positioned".

Simply stated, the Examiner's Answer *fails to show* that the apparatus of Desphandey *would even work* if the nozzle 41 of Desphandey is replaced with the showerhead assembly 52 and electrode line E_2 of Moslehi, since the apparatuses of Desphandey and Moslehi are substantially different both in structure and performance.

But even if Examiner's Answer is sufficient in showing that the apparatus of Desphandey would work if the nozzle 41 of Desphandey is replaced with the showerhead assembly 52 and electrode line E_2 of Moslehi, the Examiner's Answer fails to show that the showerhead assembly 52 of Moslehi, if substituted for the nozzle 41 of Desphandey, would result in the tungsten filament 46 being arranged between a base (such as the substrate 24) and the showerhead assembly 52 of Moslehi that has replaced the nozzle 41.

Doi arguable teaches the combination of a substrate 14 between an RF electrode 11 and a grounded holder 16 (Doi at figure 1). No comparable components are found within Desphandey. Thus, the apparatus of Desphandey is substantially different from the apparatus of Doi.

In addition, since a catalyzer is absent from within Doi, this reference also fails to disclose, teach or suggest a catalyzer is arranged between the base and an electrode for applying the electric field.

Thus, the Examiner's Answer fails to disclose, teach or suggest Desphandey, Doi and Moslehi, either individually or as a whole, as providing a catalyzer that is arranged between the base and an electrode for applying the electric field.

Regarding the rejection of claim 21 under 35 U.S.C. §103 as being allegedly obvious over Desphandey in further view of Shrank, within claim 21, the catalyzer is heated in a hydrogen-based gas atmosphere before supplying the material gas.

The above-noted deficiencies found within Desphandey are applicable to the rejection of claim 21 is incorporated by reference into the following discussion regarding claim 21.

The Examiner's Answer admits that Desphandey fails to disclose, teach or suggest the catalyzer being heated in a hydrogen-based gas atmosphere before supplying the material gas, and applies Shrank for this feature admittedly deficient from within Desphandey.

Shrank arguably teaches a process of manufacturing tungsten filaments for an incandescent lamp (claim 1), and arguably teaches that this treatment increases the life of an incandescent lamp (column 1, lines 41-43). However, there is no teaching in the cited prior as to why the skilled artisan in the chemical vapor deposition art would have looked to the incandescent light art, and specifically to Shrank, for the features deficient within Desphandey.

The Examiner's Answer contends that Shrank is reasonably pertinent to the particular problem that the Applicant is concerned with.

In response to this contention, Shrank arguably teaches that hydrogen can be detrimental to filament life by causing filament embrittlement (Shrank at column 1, lines 21-23). However, the Examiner's Answer fails to show that "filament embrittlement" is a problem with which Applicant was concerned.

Shrank arguably teaches that in quartz-halogen incandescent lamps, hydrogen liberated from the filament during lamp operation can interfere with the regenerative cycle of the halogen, thereby reducing lamp life (Shrank at column 1, lines 23-36). However, the Examiner's Answer fails to show that "hydrogen liberated from the filament during lamp operation" is a problem with which Applicant was concerned.

Shrank arguably teaches that tungsten is readily absorptive and can absorb hydrogen merely by exposure to the atmosphere. However, the Examiner's Answer fails to show that "the absorptiveness of hydrogen merely by exposure to the atmosphere" is a problem with which Applicant was concerned.

Thus, the Examiner's Answer fails to disclose, teach or suggest Desphandey and Shrank, either individually or as a whole, as providing that the catalyzer is heated in a hydrogen-based gas atmosphere before supplying the material gas.

Conclusion

The prior art of record, either individually or as a whole, fails to disclose, teach or suggest all the features of the claimed invention. For at least the reasons set forth hereinabove, the rejection of the claimed invention should not be sustained.

Therefore, a reversal of the Final Rejection of June 3, 2003 is respectfully requested.

If any fee is required or any overpayment made, the Commissioner is hereby authorized to charge the fee or credit the overpayment to Deposit Account # 18-0013.

Dated: October 25, 2004

Respectfully submitted,

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